

Patent Claims

1 1. A hard metal substrate body comprised of a WC hard
2 material phase and a binder phase of 3 to 25 mass % which apart
3 from at least one of the binder metals Fe, Co and/or Ni contains up
4 to 15 mass % of the binder phase dissolved dopant selected from the
5 group comprised of Al, Cr, V, Nb, Ta, Ti, Zr, Hf, characterized in
6 that the percentage proportion of all doping agents in the hard
7 metal is limited to a maximum of 4 mass % in that the proportion of
8 a cubic phase in the hard metal is less than 4 volume % and in that
9 the binder metal content in a hard metal-substrate body boundary
10 zone falls from up to 1 μm , preferably up to 0.5 μm to less than
11 0.5 times the binder content in the substrate body interior.

1 2. The hard metal substrate body according to claim 1
2 characterized in that the concentration of the binder phase falls
3 gradually toward the substrate body surface and the concentration
4 of the dopant gradually increases in a corresponding manner.

1 3. The hard metal substrate body according to claim 1 or
2 characterized in that the grain size of the WC is $\leq 1.5 \mu\text{m}$
3 whereby the WC fine hard metal (grain size $\leq 0.8 \mu\text{m}$) and/or with WC
4 ultrafine grain hard metal (grain size $\leq 0.5 \mu\text{m}$), preferably
5 contain Cr, V and/or Ta as dopant.

1 4. The hard metal substrate body characterized in that
2 at lest one layer is applied to the substrate body surface, the
3 layer being comprised of a carbide, nitride and/or carbonitride of
4 Ti, Zr and/or Hf and/or of Al_2O_3 , HfO_2 , ZrO_2 , oxides, amorphous
5 carbon, diamond, cubic boron nitride, carbon nitride (CN_x) or
6 another compound of at least one of the elements B, C, N and/or O.

1 5. The hard metal substrate body according to claims 1
2 to 4 characterized in that in the boundary zone close to the
3 surface there is an enrichment with nitride or carbonitride of the
4 metal dopant.

1 6. A method of producing a hard metal substrate body
2 according to one of claims 1 to 5 in which the starting mixture is
3 preheated powder metallurgically is prepressed to a green body and
4 then in an atmosphere of a furnace is heated and sintered,
5 characterized in that in the heating phase, after reaching the
6 eutectic, but no later than reaching the sintering temperature the
7 vacuum or inert gas atmosphere is replaced with a N_2 atmosphere
8 with a N_2 pressure of $\leq 10^5$ Pa and is maintained at least until the
9 sintering temperature is reached.

1 7. The method of making a hard metal substrate body
2 according to one of claims 1 to 5 in which the starting mixture is
3 powder metallurgically treated and is pressed to a green body and

4 finally heated in an atmosphere of a furnace and sintered,
5 characterized in that after finish sintering or optionally in a
6 final treatment above the eutectic temperature, the sintered body
7 is maintained in a N_2 atmosphere under a pressure (p) of $10^5 \text{ Pa} < p$
8 $< 10^7 \text{ Pa}$ for at least 10 minutes.

1 8. The method according to claim 6 or 7 characterized in
2 that the nitrogen atmosphere is established by introducing
3 precursors that is N-containing gases whereby the nitrogen is
4 formed *in situ* in the gas atmosphere.

1 9. The method according to one of claims 6 to 8
2 characterized in that the body is heated up to 1250°C during the
3 heating phase and this temperature is held for at least 20 minutes,
4 preferably more than 1 hour, before the heating up is continued to
5 the sintering temperature.

6 10. The method according to one of claims 6, 8 or 9
7 characterized in that initially in the heating up phase at about
8 1200°C the previously existing vacuum is replaced by an inert gas
9 atmosphere, preferably with a pressure of 10^3 Pa to 10^4 Pa and only
10 upon reaching the sintering temperature is a nitrogen containing
11 atmosphere established with a higher pressure, preferably $\geq 10^4 \text{ Pa}$.

11

1 11. The method according to one of claims 6 to 10
2 characterized in that the heating up rate and the cooling down rate
3 amounts to up to 10°C/min, preferably between 2°C/min and 5°C/min.

1 12. The method according to one of claims 6 to 11
2 characterized in that the starting mixture contains up to 15 mass %
3 of the binder phase additional carbides, nitrides, carbonitrides of
4 the elements of Group IVa or VIa of the periodic system or Al or
5 complex carbides, complex nitrides and/or complex carbonitrides of
6 the form Ti_2AlC , Ti_2AlN , Cr_2AlN , Cr_2AlC .